

## LEAFY SALAD VEGETABLES AND FLOWER VEGETABLES

### Quality attributes

Compact heads  
Free from injury, bruising,  
insect damage  
Minimal wilt

### Quality retention

High spoilage risks  
Refrigerate at 32°F,  
95 to 100% relative humidity



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## Leafy and Flower Vegetables - Quality Attributes and Quality Control Storage

### Quality Attributes

Quality of leafy vegetables (e.g., lettuce, cabbage, romaine, spinach, etc.) is determined by the presence of crisp leaves with no evidence of wilt, rot, or freeze damage. Hard, pale and oversized heads of lettuce and cabbage should be avoided because they are overgrown and taste bitter. A common quality problem found in lettuce is the development of russet spotting. This condition is indicated by the presence of rusty-brown spots on the lower ribs of outer leaves and is caused by the presence of ethylene gas, a by-product of fruit and vegetable decomposition.

Darkness of the cut stems of lettuce or cabbage is also an indicator of age. The stem darkens in direct proportion to temperature and time. Lettuce that is field-chilled has the highest quality and does not brown as rapidly when cut. Heads of lettuce and cabbage should be compact and well trimmed to ensure good cutting yield.

Good quality flower vegetables (e.g., celery, asparagus, broccoli, cauliflower etc.) should be fresh, not limp, with compact, well-colored crisp stalks and tender tips. (These vegetables should be trimmed and tough woody stems should have been removed.) The sweetness and tenderness of asparagus can be lost easily if the product becomes warm, ages, the tip opens, or the stalk wilts and becomes stringy.

Vegetables may easily carry insects, herbicide residue, and microorganisms. Care must be taken to purchase and store them carefully and to wash the vegetables thoroughly before they are cooked or eaten raw.

### Quality Retention

To retain highest quality for the longest period of time, these vegetables should be stored at 32°F and in a humid environment (95 to 100% relative humidity).

### References

Ryder, E.J. 1979. Leafy Salad Vegetables. Avi Publishing Co. Westport, CT.

## TUBERS, ROOT VEGETABLES, AND SQUASH

### Quality attributes

Firm, well shaped  
Appropriate color, size, trim  
Free from sprouts, sunburn,  
harvest damage

### Quality retention

Store roots at 32°F,  
95% relative humidity;  
tubers at 40 to 50°F,  
70% relative humidity,  
in dark to prevent sprouting



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## Tubers, Vine and Root Vegetables - Quality Attributes and Quality Control Storage

### Quality Attributes

**Tubers, squash, and root vegetables** can be stored successfully for much longer than other vegetables. Root vegetables should be clean and have a short length of top retained. The microbial hazards of these vegetables are the spores of *Clostridium botulinum*, *Clostridium perfringens*, and *Bacillus cereus*, which may not be washed off and may grow out to form vegetative cells / toxins in the cooked products where spoilage organisms no longer exist to inhibit their growth.

Potato quality attributes are firmness, smooth skin for easy cleaning, good shape for easy peeling, and no major defects. Some major defects are greening (due to sunlight), harvesting scars, bruises, and hollow heart (a brown, open area in the center of the tuber). Green areas must be removed because they can be due to the formation of a toxic compound known as solanine. Some varieties of potatoes darken after cooking. This seems to be related to the acid and iron content of the soil in which they were grown.

Potatoes are sized by counts per bushel or by weight. When buying potatoes, variety, grade, and size should be specified. Specific gravity determines whether the potato will be mealy or waxy when cooked. A specific gravity of at least 1.08 is desirable for baking or mashing; 1.07-1.08 for boiling; and below 1.07 for frying.

Quality attributes of onions and garlic are hardness, dry skin with small necks, and no softness or wetness. There should be no evidence of green sunburn or sprouting. Strong onions store for a longer period of time than do mild onions due to their higher content of pyruvic acid. Firm, smooth, and well-shaped onions and garlic are essential to ease of preparation and minimal waste.

### Quality Retention

Potatoes should be stored at 40 to 50°F, 70% humidity. Colder temperatures cause potatoes to produce sugar from starch reserves. Potatoes stored at refrigeration temperatures brown excessively when cooked, particularly when fried.

For best quality retention onions and garlic should be refrigerated at 32°F and stored in a relatively high humidity of 95%.

### References

- Goepfert, J. M. 1980. Vegetables, fruits, nuts, and other products. In *Microbial Ecology of Foods, Vol. II. Food Commodities*. Academic Press. New York, NY.
- Pedderson, R. B. 1977. *Specs: The Comprehensive Food Service and Specification Manual*. Cahner's Books International, Inc. Boston, MA.

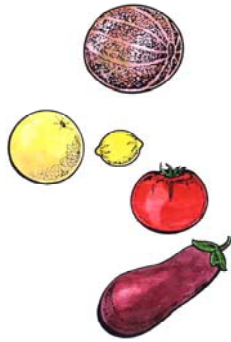
## FRUITS AND SOFT-SKINNED VEGETABLES

### Quality attributes

- Evenly shaped
- Uniform color
- Free of bruises, rot, mold, cracks

### Quality retention

- Store ripe fruits at 40 to 50°F, 85 to 90% relative humidity
- Store mature green tomatoes at 55 to 70°F to assist ripening



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## Fruits and Soft-Skinned Vegetables - Quality Attributes and Quality Control Storage

### Quality Attributes

Select fruits and vegetables on the basis of measurable and easily identifiable quality attributes. These quality characteristics should be listed on purchasing orders so that consistent products are purchased and uniform standards are used to accept or reject items as they are delivered by suppliers.

### Fruit Quality and Storage

For highest quality retention, inspect all fruit. Use damaged fruit immediately and discard soft, watery, or moldy fruit. Place fruit into clear polycarbonate tubs to make daily inventory more efficient, reduce storage space requirements, and facilitate early detection of mold growth. If mold is allowed to grow and produce spores that become air-borne, the mold may cause fairly extensive product loss. Refrigerate below 41°F, at 80 to 85% relative humidity. Do not mix storage of fruits with vegetables.

Note: The count on the citrus fruit case actually refers to the diameter of the fruit and not the number in the box. For example: Grapefruit 56 count means: Minimum Diameter = 4 2/16", Maximum Diameter = 4 12/16". Some Florida fruit is larger than Texas or California fruit of the same count due to a separate USDA quality grade status.

Apples are packed by count or minimum diameter. In general, apple quality is measured by degree of firmness, weight, and amount of sugar in the juice. For quality attribute retention, apples should be stored near 32°F. Apples soften nearly 5 times as quickly at 41°F as at 32°F.

Pears are best when picked green and are allowed to ripen off the tree. The starch stored in the flesh forms sugars during ripening, thus increasing the sweetness of the fruit.

Ripeness is often determined by feel and aroma that is characteristic for the fruit. Ripe peaches and nectarines yield to thumb pressure. Peaches are best if tree ripened, because they contain no starch reserves that convert to sugar after they are picked.

Berries (e.g., strawberries, raspberries blueberries) should be uniform in size and color, clean, dry, and free from leaves and stems. Ripeness is indicated strictly by color.

Overripe fruit is soft, dull in appearance, and watery. To retain quality of fully ripe fruit, it should be stored at 32°F and 90% relative humidity.

Melons (e.g., watermelons, cantaloupes, honeydews) are like peaches and have no starch reserves to turn to sugar upon ripening. Melons should be allowed to ripen on the vine. Melons should be sweet and have texture characteristic of the fruit. (Melon thumping has no merit.) For best quality retention of fully ripened melons, they should be stored at 45 to 50°F and 85 to 95% relative humidity.

The skin color of bananas is an excellent indication of the stage of ripeness. There are 7 established stages of ripeness related to the stages from solid green to speckled, fully ripe restaurant bananas. Green bananas can be ripened by allowing them to remain at 58°F until the desired state of ripeness is reached. Fully ripe bananas should be stored at 41°F in 85 to 95% relative humidity and used within a few days.

Tomato quality attributes are color, firmness, general interior appearance in terms of percent seeds, percent flesh and wall, and flavor. Color and size can be used to determine maturity. Tomatoes picked prior to ripening ship well and reduce the risk of loss to the grower and shipper, but do not taste vine-ripened. In order to get the freshest tomato flavor and the optimum in quality, vine-ripened tomatoes must be specified on orders. Tomatoes may be ripened at 55 to 70°F and refrigerated at 41°F to maintain quality.

Avocados may be picked when under-ripe and allowed to ripen at room temperature. Avocados are fully ripe when they yield to slight thumb pressure. Fully ripened avocados should be stored at 41°F and 85 to 95% relative humidity to maintain high quality for as long as possible.

### Vegetable Quality and Storage

Fresh green beans should be well shaped and colored, clean, and free from marks or disease. The beans, when broken should snap with a crack. They should not be wilted or limp, which is a sign of moisture loss. To retain highest quality in fresh green beans, they should be washed prior to storage.

The best-tasting peppers are those with thick walls and a uniform-glossy color. Small brown specks on the exterior of pepper are a sign of hail damage and are considered a defect.

Color, size, and shape are used as quality indicators for many vegetables, including cucumbers and eggplant. For best quality, store these fresh vegetables at 45 to 50°F.

### References

- Frazier, W.D., and Westhoff, D.C. 1978. Food Microbiology. 3rd ed. McGraw-Hill, Inc. New York, NY.
- Kotschevar, L.H. 1975. Quantity Food Purchasing. 2nd ed. John Wiley & Sons. New York, NY.
- Pedderson, R.B. 1977. Specs: The Comprehensive Food Service and Specification Manual. Cahner's Books International, Inc. Boston, MA.

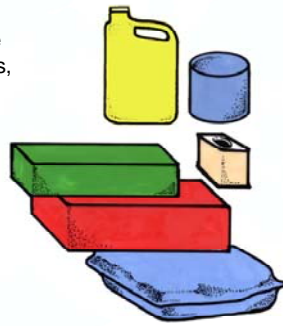
## GROCERY DRY STORAGE ITEMS SALAD OIL, CANNED FOODS, HERBS, SPICES

### Quality attributes

Quality decrease with storage  
Package has no holes, breaks,  
cracks, rust, dents  
Natural aroma  
No oxidation

### Quality retention

Store at 60 to 70°F,  
65 to 70% relative humidity  
First in, first out  
Avoid infestation  
Herbs and spices must be  
replaced at least every 6 months



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quantities to be used within 3 months. Spices should be stored in tightly covered, dark glass containers, in a cool and dry place such as the refrigerator or freezing unit.

Oil becomes very rancid, especially olive oil, after opening when exposed to the atmosphere. Opened containers of oil retain freshness longer when stored at refrigeration temperatures.

The flavor of coffee deteriorates rapidly after grinding due to loss of volatile flavor components. Coffee and tea should be bought in quantities that will be used in a short period of time (within 1 week) and stored in a cool, dry place, in tightly covered containers to retard flavor loss.

### References

- Frazier, W.C., and Westhoff, D.C. 1978. Food Microbiology. 3rd ed. McGraw-Hill, Inc. New York, NY.  
Kotschevar, L.H. 1975. Quantity Food Purchasing. 2nd ed. John Wiley & Sons. New York, NY.

## Grocery / Dry Storage Items - Salad Oil, Canned Foods, Herbs, Spices

### Dry Food Quality

Dried products have had enough water removed to prevent bacterial growth. Care must be taken to ensure that dried products stay dry. Original containers must be checked to make sure that the moisture seal has not been broken. The freshness of dried products may be checked by evaluating their aroma. Fats in dried foods will slowly become oxidized, producing off-odors. Leavening agents in cake, biscuit, and muffin mixes can react in the package, thus reducing leavening power and final quality of baked products. Pigments in dried vegetables and spices undergo oxidation resulting in color loss in these products. Volatile flavor compounds are also lost with prolonged storage. High temperatures and moisture will speed the deterioration of most dried foods. When packages are opened or damaged, the product should be used quickly to prevent rapid deterioration due to exposure to atmosphere.

Rice, beans, flour, and sugar are subject to pest infestation, to absorbing moisture, and to becoming contaminated by soil if the package is damaged. These foods should be stored in approved food storage containers that prevent absorption of moisture and entrance of vermin and insects.

### Canned Food Quality

Canned products are fairly shelf stable because the canning process eliminates air and inactivates most microorganisms and spores. Canned goods are best if stored at temperatures no higher than 60 to 70°F.

### Quality Retention

For the best quality retention of dry storage items, they should be stored at 60 to 70°F at a low (65 to 70%) relative humidity. All opened, dried products should be placed in labeled containers with tight fitting lids. Items should be rotated and used as quickly as possible. Insect and rodent infestation can be controlled by keeping dried food in tightly covered metal, glass, or plastic containers.

The flavor and odor of dried herbs and spices can change drastically within 6 months, causing variation in recipes and product quality. Spices must be purchased in small enough

